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ABSTRACT:

A trocar sleeve of the kind having a widened part forming a housing between the distal portion of the sleeve and its proximal portion, which latter extends from a plug for the widened housing part, and a normally closed ball valve in the widened housing part openable by a trocar passing through the sleeve. The widened part forming the housing receives an insert of U-shaped cross section secured to the plug to stress an inserted sealing gasket of deformation-resistant plastics material which provides a valve seating. The space in the U formed by the insert forms a space for the ball of the ball valve to move in, and the ball, is connected to a shaft insertable in the insert and carrying a tangentially loaded helical spring.

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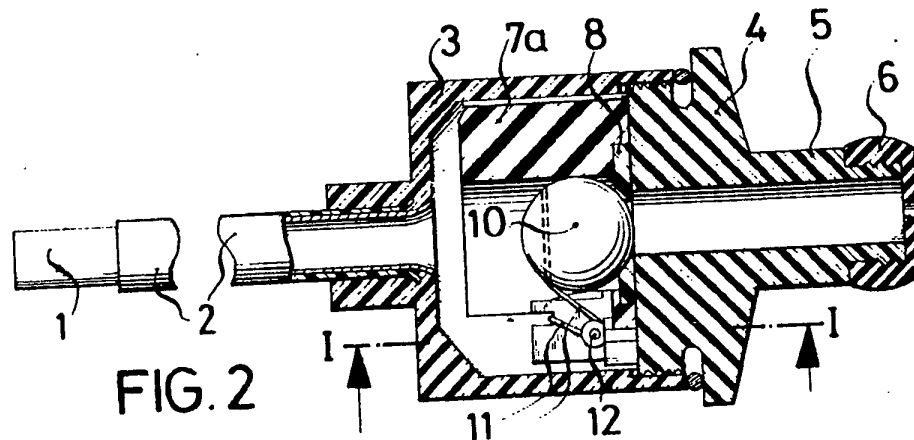
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## (54) Ball Valve Assembly

(57) A trocar sleeve has a widened part 3 containing a ball valve 10 closable by a spring 11 and openable by a trocar passing through passage 5 of the sleeve. The ball 10 is located in an

insert 7a of U-shaped cross-section secured to a plug 4 by screws (9). A sealing gasket 8 of deformation-resistant plastics material clamped between the insert 7 and plug 4, is drilled after assembly to form the valve seating. The ball and spring assembly is mounted to the insert 7 before the latter is secured to the plug, whereby connecting the insert to the plug places the spring 11 under stress.



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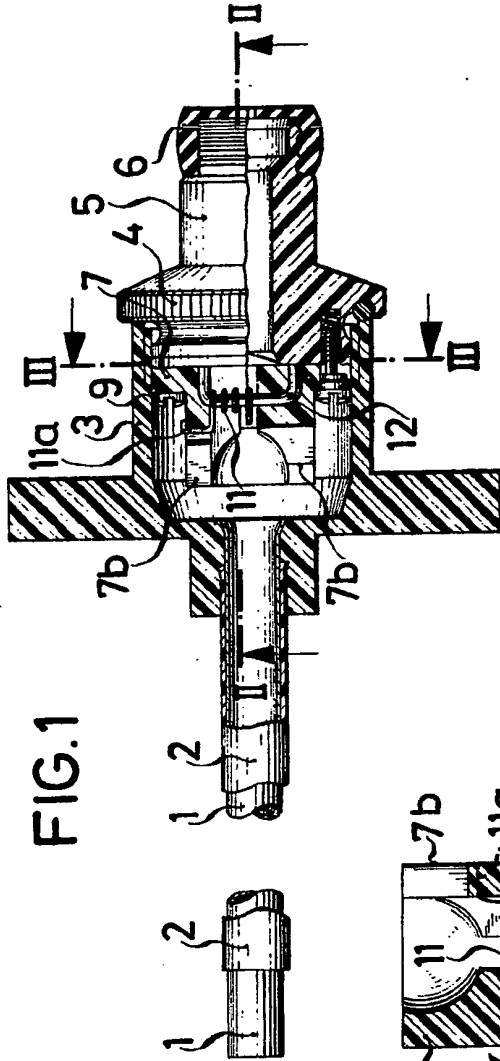


FIG. 1

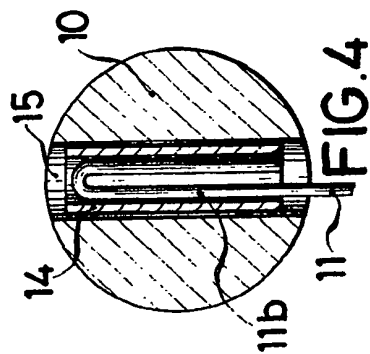


FIG. 4

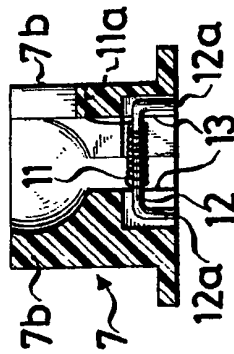


FIG. 5

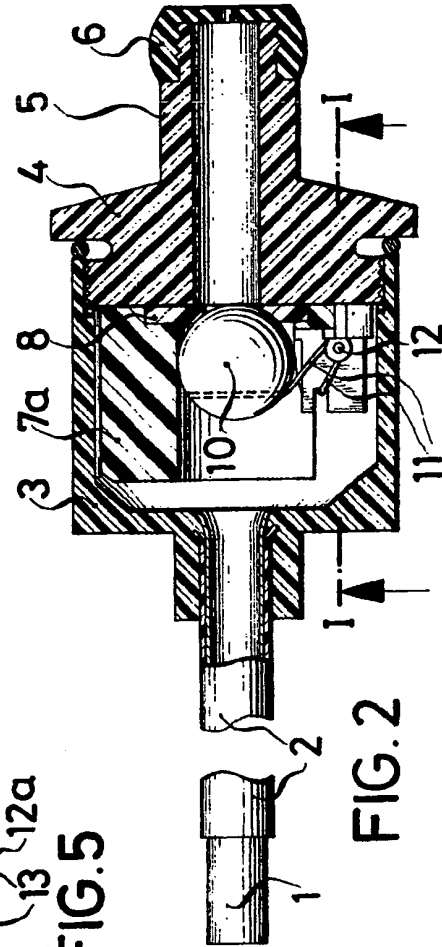


FIG. 2

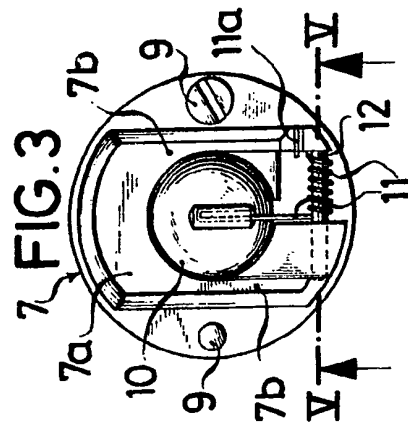


FIG. 3

# SPECIFICATION Improvements in or Relating to Trocar Sleeves

This invention relates to trocar sleeves (sometimes referred to as cannuli), of the kind having a widened part forming a housing between the distal portion of the sleeve and its proximal portion, which latter extends from a plug for the widened housing part, and a ball valve in the widened housing part which ball valve is closable by resilient means and which is operable by a trocar passing through the sleeve. Hereinafter such a trocar sleeve will be referred to as "of the kind described".

It is known to provide trocar sleeves or cannuli between their proximate and distal portions with a widened part which forms a housing and in which a magnetic flap valve is resiliently mounted, as described in German Gebrauchsmuster 7 430 345 and British Patent Specification no. 1482857, so that the sleeve be sealed after the trocar has been withdrawn and in this way any escape of gas from say, an abdominal cavity, can be prevented. Practical experience has shown that after a given period of time an arrangement of this kind no longer performs its appointed function.

It is also known as described in German Auslegeschrift 1 267 377 to fit, in the widened proximal part of the sleeve, a ball valve whose ball is pressed against a valve seating by a tangentially loaded helical spring but is able to move aside when the trocar or an instrument is passed through. This known design results in the sleeve having an eccentrically projecting widened portion and is expensive.

It is an object of the invention to simplify the construction of a ball valve and its fitting to a trocar sleeve of the kind described, with the valve seating accurately aligned, and to reduce manufacturing costs while providing a long life.

Accordingly, the invention consists in a trocar sleeve of the kind described, wherein the widened part forming the housing receives an insert of U-shaped cross-section and which may be made from a plastics material, which is screwable to the plug to stress an inserted sealing gasket of deformation-resistant material which also may be a plastics material and which is to be drilled through to form a valve seating, and wherein the space in the U formed by the insert forms a space for the ball of the ball valve to move in, and which ball, before the insert is screwed to the plug, is connected to a shaft insertable in the insert and carrying a tangentially loaded helical spring and is placed under stress by connecting the insert to the plug.

By this means it is possible to stress the sealing gasket of deformation-resistant material and press it firmly into place, while sealing off the internal passage, when U-shaped insert is screwed to the plug carrying the proximal portion of the sleeve, and then to drill it out through the proximal portion of the sleeve to the requisite inside diameter by means of a stepped drill, thus

obtaining an absolutely central bore in the gasket and a satisfactory seating for the ball of the valve. A tangentially loaded helical spring which is free to move is freely inserted in the U-shaped insert connected to the plug and is held secure by the way in which it fits into the insert. The insert is then screwed up to the plug and the drilled out valve seating, as stated above, by which means the helical spring is placed under stress. The plug, together with the U-shaped insert, is then screwed into the widened part forming the housing.

The fitting of the spring mounting for the ball of the valve is particularly facilitated if, in a further embodiment, the ball of the ball valve is provided with a transverse groove opposite the valve seating, for a flat tube secured in the groove to receive a tangential portion of the helical spring which is bent into a hair-pin shape and which is connected at its free end to the tube, the turns of the spring enclosing the central section of an arch-shaped shaft which is inserted in recesses parallel to the axis of the insert in the side-pieces of the U-shaped insert on the side adjacent the plug, the other tangential portion of the spring being supported in one of the side-pieces of the U-shaped insert.

In order that the invention may be more clearly understood, reference will now be made to the accompanying drawings which show one embodiment thereof by way of example and in which:—

Figure 1 is an axial section through the proximal part of the trocar sleeve with an interrupted side-view of the distal part thereof,

Figure 2 is an axial section of the sleeve, viewed at right angles to Figure 1,

Figure 3 is an end-on view of the insert looking from line III—III of Figure 1.

Figure 4 is an enlarged scale end-on view of the side of the ball of the ball valve opposite the valve seating.

Figure 5 is a section through the insert on line V—V of Figure 2 or 3.

Referring now to the drawings, a metal trocar sleeve 2, (also referred to in the art as a trocar cannula) which is provided with an internal tubular insert 1 of insulating plastics material, is firmly connected at the proximal end to a widened part 3 forming a housing which can be closed off by a screw-in plug 4 carrying the proximal portion 5 of the sleeve. The housing part 3, the plug 4 and portion 5 of the sleeve likewise consist of a suitable plastics material in this embodiment. Portion 5 of the sleeve is provided with a rubber cap 6 having a central aperture to provide sealing passage for a trocar, a telescope, an endoscope or instruments.

To seal off the trocar sleeve 1, 2 after the trocar or the instruments have been withdrawn, a ball valve is fitted in the widened housing part 2.

In this embodiment this valve comprises an injection-moulded plastics insert 7 of U-shaped cross-section perpendicular to the axis of the sleeve. On the plug side, the insert 7 is provided

with a circular recess for the insertion of a sealing gasket 8 (Figure 2) of heat-resistant and deformation-resistant material, such as a suitable plastics material, which can be pressed firmly into place under stress and while sealing off the internal passage, by connecting the insert 7 to the plug 4 by means of screws 9. After parts 7 and 4 have been screwed together, the sealing gasket 8 is provided with an exactly central bore of the requisite diameter by means of a stepped drill guided in portion 5 of the sleeve, and the resulting sealing ring then acts as a valve seating for the ball of a ball valve.

Before the valve-seating ring 8 is finally tightened down, or in other words before the insert 7 is finally connected to the plug 4, a unit consisting of a valveball 10 and a tangentially loaded helical spring 11 carried on an arch-shaped shaft 12 is inserted in the insert 7. For this purpose the side-pieces 7b of the insert 7 are provided on the side adjacent the plug 4 with recesses 13 parallel to the axis of the insert into which are fitted the side-sections 12a of the arch shaped shaft 12, onto whose central section the turns of the torsion spring 11 have been slid. One end 11a of the spring is hooked into a notch in one side-piece 7b of the U (Figures 1, 3 and 5) and the other end 11b of the spring, which is bent into a hair-pin shape, is inserted in a flat tube 14 which is secured in a transverse groove 15 in the valve-ball 10 on the side remote from the plug (Figure 4). The free end of the hair-pin portion 11b is solidly connected to the tube 14, by welding for example.

In this way the valve-ball 10, together with its spring mounting 11 and the shaft 12 for the spring, is connected to the insert 7, while being free to move and is held fast in the insert 7, the spring being relaxed initially. Then, after the valve seating ring 8 has been inserted, the insert 7, together with the spring and the valve-ball, is screwed to the plug and at the same time the helical spring 11 is thus placed under stress, by which means the valve ball 10 is brought to bear against the valve seating 8.

The plug 4, together with the complete valve insert 7, is then screwed to the widened housing

part 3 and fitting is thus complete.

To perforate the wall of a patient's abdomen, a trocar is pushed through the trocar sleeve or cannula so produced and lifts the valve ball off the seating and forces it aside, the sealing function then being taken over by the rubber cap 6 and the ball 10 being allowed a limited amount of movement on the hair-pin shaped tangential portion 11b of the spring 11, any damage to the valve-ball 10, which in any case is only subject to point or line contact, being largely obviated by its withdrawing movement and any breakage of the spring at the ends of its tangential portions being virtually impossible.

#### Claims

1. A trocar sleeve of the kind described wherein the widened part forming the housing receives an insert of U-shaped cross-section which is securable to the plug to stress an inserted sealing gasket of deformation-resistant plastics material which is to be drilled through to form a valve seating, and the space in the U formed by the insert forms a space for the ball of the ball valve to move in, the ball, before the insert is screwed to the plug, being connected to a shaft insertable in the insert and carrying a tangentially loaded spring and being placed under stress by connecting the insert to the plug.
2. A trocar sleeve as claimed in claim 1, wherein the ball of the ball valve is provided with a transverse groove opposite the valve seating, for a flat tube secured in the groove to receive a tangential portion of the helical spring which is bent into a hairpin shape and which is connected at its free end to the tube, the turns of the spring enclosing the central section of an arch-shaped shaft which is inserted in recesses parallel to the axis of the insert in the side-pieces of the U-shaped insert on the side adjacent the plug, the other tangential portion of the spring being supported in one of the side-pieces of the U-shaped insert.
3. A trocar sleeve substantially as hereinbefore described with reference to the accompanying drawings.

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